THE BEGIN-SADAT CENTER FOR STRATEGIC STUDIES
BAR-ILAN UNIVERSITY
*Mideast Security and Policy Studies No. 94*

# The Israeli-Palestinian Water Conflict: An Israeli Perspective

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http://www.besacenter.org
ISSN 0793-1042
January 2012

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# The Israeli-Palestinian Water Conflict: An Israeli Perspective

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This research paper was supported by the
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# The Israeli-Palestinian Water Conflict: An Israeli Perspective

***Haim Gvirtzman****

## INTRODUCTION

Harsh allegations are being raised against the State of Israel due to the dispute over water with the Palestinians.[1] The Palestinians claim political and legal ownership over the groundwater reservoir of the Mountain Aquifer, including its three internal basins – western, eastern and northern. They also claim rightful access to the waters of the Gaza Strip Coastal Aquifer and the Jordan River. Quantitatively, these demands amount to about 400 million cubic meters per year (MCM/Y) from the Mountain Aquifer, about 100 MCM/Y from the Coastal Aquifer and about 200 MCM/Y from the Jordan River. This totals roughly 700 MCM/Y, which is more than 50 percent of the total natural water available between the Mediterranean Sea and the Jordan River. In addition, the Palestinians insist that they suffer from water shortages in their towns and villages due to the Israeli occupation and cite international legal norms in support of their claims.

This paper's objective is to examine the Palestinian arguments against Israel by presenting detailed information about water supply systems presently serving Israelis and Palestinians. This data, previously classified due to political sensitivities, was recently released for publication by the Israeli Water Authority for the first time after the signing of the Israeli-Palestinian Interim Agreement (Oslo II) over 15 years ago. It is presented in this study, which makes use of new maps, tables and graphs. The data shows that most of the Palestinians' arguments have no foundation. Moreover, contrary to most of these arguments, Israel has fulfilled all of its obligations according to the signed water agreements with the Palestinian Authority (PA).[2]

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In fact, the issue of water scarcity could be changed from a source of controversy and tension to one of understanding and cooperation if both sides are prepared to start planning future water supply plants together. Israeli-Palestinian cooperation based on academic research[3] is a good starting point. Cooperation based on sustainable development and advanced technologies can solve the real water deficiency.[4] This paper presents practical plans to efficiently overcome the water shortages of both sides.

## DEVELOPMENT STAGES OF THE WATER SUPPLY SYSTEM

This section will discuss the development stages of the water supply systems in Judea and Samaria,[5] during which the ancient, traditional water supply systems were replaced by modern ones. The stages included are the British Mandate period (1917-1848), the Jordanian Kingdom period (1948-1967), and the Israeli administration period (1967-1995). The post-1995 period, during which the Interim Agreement between Israel and the Palestinians was implemented, is described separately in the next section.

### The British Mandate Period (1917-1948)

The traditional, ancient water supply systems that were built in households and communities hundreds and maybe thousands of years ago were still widely in use during the British Mandate period.[6] These included aqueducts that conveyed spring water by gravitation and cisterns that collected rainwater. Three irrigation systems were active on the eastern slopes of the Judea and Samaria mountains. The Wadi Qelt aqueduct provided a total of 3 MCM/Y from Ein Fara, Ein Fawar and Ein Qelt to Jericho; the Wadi Uja aqueduct brought 7 MCM/Y from Ein Uja to the Uja Valley; and the Wadi Faria aqueduct supplied 5 MCM/Y from Ein Baidan, Ein Isca and Ein Shibli to the Giftlik. Two additional Roman systems for domestic consumption were active in the high mountains: the Nablus aqueduct (2 MCM/Y from Ras-El-Ein, Ein Kariun and Ein Asal to Sabastia) and the Jerusalem aqueduct (1 MCM/Y from the Biar and Arub springs). In addition, about 200 small springs were utilized all over the mountain range, each for local consumption, both domestic (by carrying water cans) and agricultural (by flooding mountainous terraces). Also, many cisterns collecting

rainwater at the household level were used. These springs and cisterns supplied 5 MCM/Y during rainy years and were almost dry during droughts.[7]

During the British Mandate, two modern, electric powered plants supplying water to Jerusalem (from Ein Fara) and Ramallah (from Ein Samiya, Ein Kinya and Ein Ariq) were built, with a total capacity of 2 MCM/Y.[8] Thus, at the end of the British period, the maximum water supply in the Judea and Samaria mountains was 25 MCM/Y (in rainy years).

**Jordanian Rule (1948-1967)**

During most of the period of Jordanian rule in Judea and Samaria the water supply system remained unchanged. However, in 1965 new drilling technology was introduced and 350 wells were drilled, supplying a total of 41 MCM/Y. Most of these wells were shallow (10-70 meters deep), equipped with thin casing (5-12.7 centimeter diameter), and operated with weak engines (5-50 horse power); thus, they were pumped at low rates (10-70 $m^3$/hour). Yet, some of the wells were relatively large, specifically those drilled at El-Fawar near Hebron, Bet-Fajar near Bethlehem, Deir-Sharaf near Nablus, and Bardala in the Jordan Valley. Out of the 41 MCM/Y, 19 MCM/Y were pumped in west Samaria (Qalqiliyah, Tulkarm and Anabta), 5 MCM/Y in north Samaria (Jenin and Qabatiyya), 1 MCM/Y in Judea, and 16 MCM/Y in the Jordan Valley (Jericho, Uja, Giftlik and Bardala).

Due to the addition of these wells during the Jordanian period, the maximum water supply was 66 MCM/Y (in rainy years), most of which was used for agriculture. Throughout this time, however, only four of the 708 Palestinian towns and villages were connected to modern water supply systems and had running water.[9]

**The Israeli Administration (1967-1995)**

Given the lack of running water in most towns and villages in 1967, the Israeli administration drilled deep, wide wells adjacent to most of the large urban centers and connected them through a network of

pipelines. The bigger wells were the three Dotan wells near Jenin, the Beit-Iba, Horon and Tapuach wells near Nablus, and the seven Herodion and Shdema wells near Bethlehem. The Israeli administration helped the Municipality of Nablus in drilling the two Baidan wells and assisted the Municipality of Ramallah in drilling the two Samia wells. Thus, in the first five years of the Israeli administration, the water supply to the Palestinians increased by 50 percent, most of which was designated for domestic consumption.

In the late 1970s and 1980s, as many new Jewish settlements were built in Judea and Samaria, they were connected to the Israeli National Water Carrier (that passes along the coastal plain) by long pipelines. Consequently, the Palestinian villages and towns located along the pipelines were connected to running water as well and the standard of living in these communities increased considerably.

From 1967-1995 (prior to the signing of the Israeli-Palestinian Interim Agreement), the total amount of water supplied to the Palestinians in Judea and Samaria increased from 66 to 120 MCM/Y. This additional water was mainly used for domestic consumption. During this period, the number of towns and villages connected to running water through modern supply systems increased from four to 309 communities.[10]

## ISRAELI-PALESTINIAN WATER AGREEMENTS

### The Gaza Agreement

As part of the Oslo Agreement in 1994, it was decided that Israel would transfer control over the Palestinians' water supply in Gaza to the PA, including the responsibility for the local aquifer and its pumping wells and the management, development and maintenance of the water and sewage systems. Only the water systems of the Jewish settlements were excluded (though in 2005, during the Israeli withdrawal from Gaza, these were also transferred to PA control). It was also agreed that Israel would transfer an additional 5 MCM/Y to Gaza via pipeline.

## The Judea and Samaria Interim Agreement

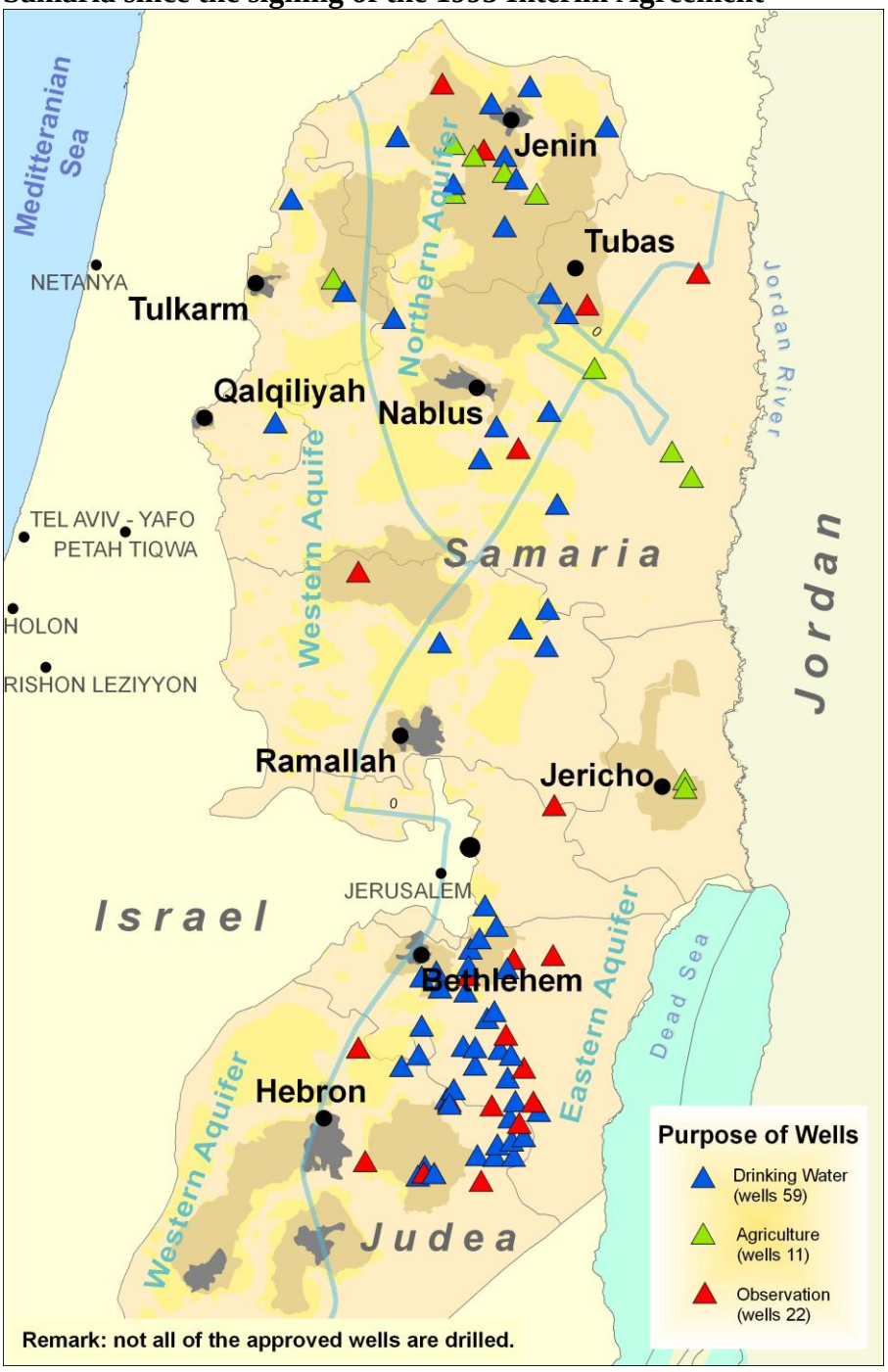
In the second Oslo Agreement, signed in 1995, Israel stated its recognition of the water rights of the Palestinians, which would be quantitatively defined in the future in the permanent agreement. Both parties concurred that the future needs of the Palestinians would be about 70-80 MCM/Y more than their existing water consumption (118 MCM/Y in 1995). During the interim period, the Palestinian consumption would increase by 28.6 MCM/Y (including the 5 MCM/Y to Gaza), most of which would be supplied from the Eastern Aquifer basin. It was also agreed that new water sources should be developed (for example, sewage recycling and seawater desalination) and that management of water sources must be coordinated. As well, both sides agreed to prevent contamination and treat sewage effluents.

## Implementing the Agreements

To implement the water agreement in Judea and Samaria, a Joint Water Commission (JWC) was established, with joint Israel-Palestinian supervision and enforcement teams, which was given permission to move freely throughout Judea and Samaria.

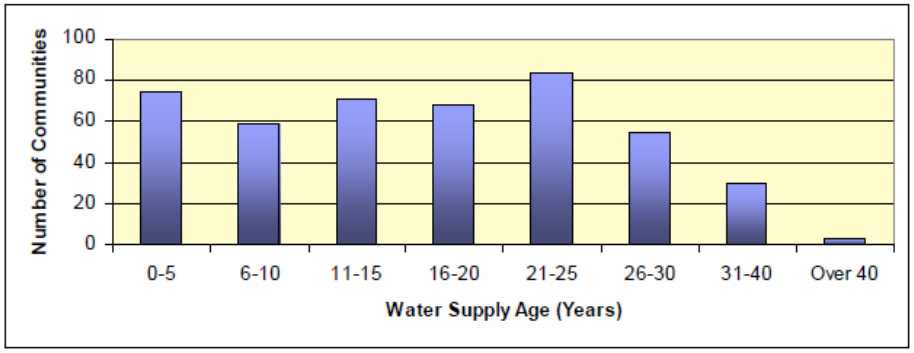
The JWC, which has worked continually over the last 15 years, even in times of tension, meets on a regular basis, approving the construction of water supply systems and sewage installations. The commission is comprised of four sub-committees. The first one is the Hydrological Committee, which has approved the drilling of about 70 new production wells for the Palestinians and 22 observation wells (see Figure 1), of which just 50 percent have actually been drilled. This committee has also approved the upgrading of 55 existing wells (out of about 500 authorized wells in Judea and Samaria). Second is the Engineering Committee, which has approved the laying of water supply pipelines along hundreds of kilometers (see Figure 2) and the construction of tens of large storage reservoirs and pumping stations. The third one is the Sewage Committee, whose work has been held back due to severe political obstacles. Thus, while international donor countries were ready to fully fund wastewater treatment plants for all the major Palestinian cities, only one such plant has been constructed (at El-Bireh). Finally, there is the Pricing Committee, which solves

**Figure 1: A map of all JWC-approved wells in Judea and Samaria since the signing of the 1995 Interim Agreement**



ongoing issues regarding the amount of payment owed by the Palestinians to Israel.

**Figure 2: The laying of domestic water pipelines over time in various Palestinian communities**[11]

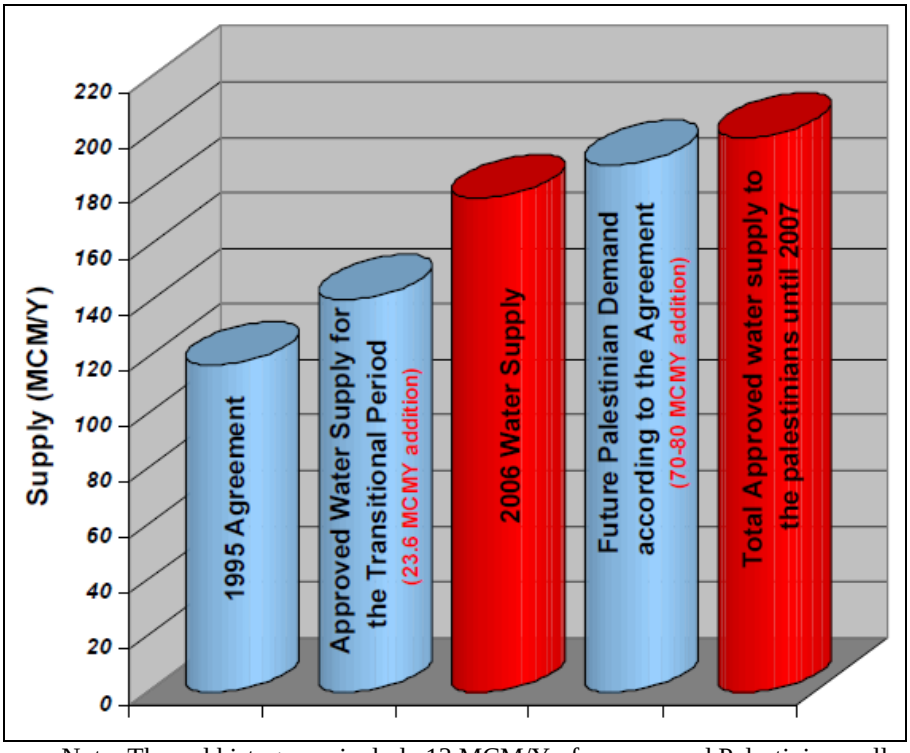



Following the signing of the Interim Agreement, the management and maintenance of all Israeli water installations remained in the hands of Mekorot (Israel's national water company) and the responsibility for all Palestinian installations was transferred to the PA. Installations that supplied water to both Israelis and Palestinians remained Israel's responsibility. However, the Israeli government at the time decided to disconnect Israeli settlements from predominantly Palestinian water networks (and reconnect them to adjacent Israeli networks). This program was accomplished over several years. These installations were thereby reclassified as Palestinian and handed over to the PA. This separation eliminated the dependence of the Israeli settlements on Palestinian management but did not lead to a full separation between Israeli and Palestinian communities. Instead, water supply pipelines belonging to the Israeli systems still included many connections to Palestinian villages and towns.

The exact quantities of water delivered to Palestinian villages and towns as part of Oslo II were monitored using standard meters, based on which monthly charges were paid according to the rate determined by the agreement (price protocol). Payment was made to Mekorot by the Government of Israel, using port taxes collected by Israel on behalf of the PA.

Over the last 15 years, the development of water supply systems for the Palestinian communities has been carried out on an extensive scale, much larger than that called for in the Interim Agreement (see Figure 3). The water agreement stated that water supply to the Palestinians would increase by 28.6 MCM/Y (of which 5 MCM/Y would be supplied to the Gaza Strip), in addition to the quantity already consumed annually, which was 118 MCM/Y (in 1995). Essentially then, it was agreed that the Palestinians' water supply in Judea and Samaria during the interim period would increase by 20 percent. In practice, however, the Palestinians' water supply increased by about 50 percent (60 MCM/Y in 2006, not including Gaza), reaching a total of 180 MCM/Y. Thus, considering the drilling of the approved wells, Israel has fulfilled its signed obligations.

**Figure 3: Amount of water supplied to the PA since the 1995 Interim Agreement**




Note: The red histograms include 13 MCM/Y of unapproved Palestinian wells.

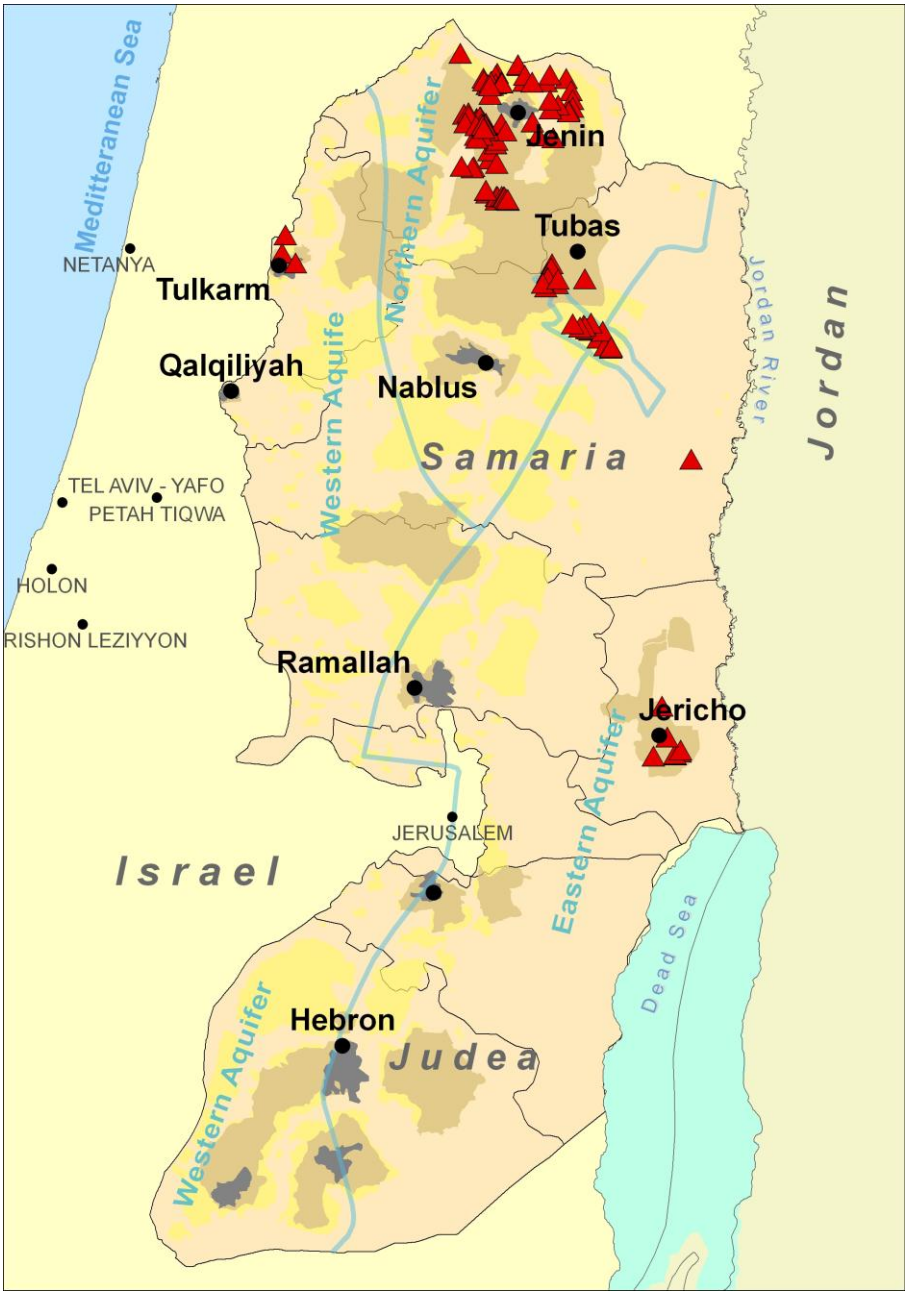
As mentioned earlier, only four of 708 Palestinian towns and villages were connected to a running water network in 1967, when Israel first took control of Judea and Samaria. By the time the Interim Agreement was signed in 1995, however, 309 communities were connected (see Figure 2). In 2000, the estimated percentage of Palestinians not connected to a water network was only 19 percent.[12] Five years later, this figure had narrowed to about 10 percent according to data collected by the Palestinian Water Authority (PWA).[13] More recently, in March 2010, 641 of 708 Palestinian communities, which include more than 96 percent of the Palestinian population, were found to be connected to a running water network. At present, water supply networks for an additional 16 villages (encompassing an additional 2.5 percent of the population) are under construction.

In comparison to its Arab neighbors, the Palestinians in Judea and Samaria now enjoy much better access to running water. In Jordan and Syria, for instance, most towns and villages are currently not connected to water supply plants.[14] Even in large towns that are connected, there is no regular water distribution. This is also the case in the respective capitals, Amman and Damascus, where water distribution takes place only once or twice each week.[15] The fact that 96 percent of the Palestinian population in Judea and Samaria has daily access to running water in fact puts them in a superior position compared to most developed countries around the world. Thus, while much criticism has been brought against Israel regarding the small percentage of Palestinian communities that remain without running water, it would be appropriate for such critics to compare these statistics to those of the surrounding Arab nations, like Jordan. They would then realize that the Palestinian water situation is superior to that of other developed nations.

**Agreement Violation by the Palestinians**

The Palestinians' ongoing drilling of unauthorized wells in the Mountain Aquifer is a clear breach of the water agreement (see Figure 4). The PA has supported these private drilling initiatives by connecting the unlicensed wells to the electrical network. By 2005, more than 250 such wells were drilled in Judea and Samaria,

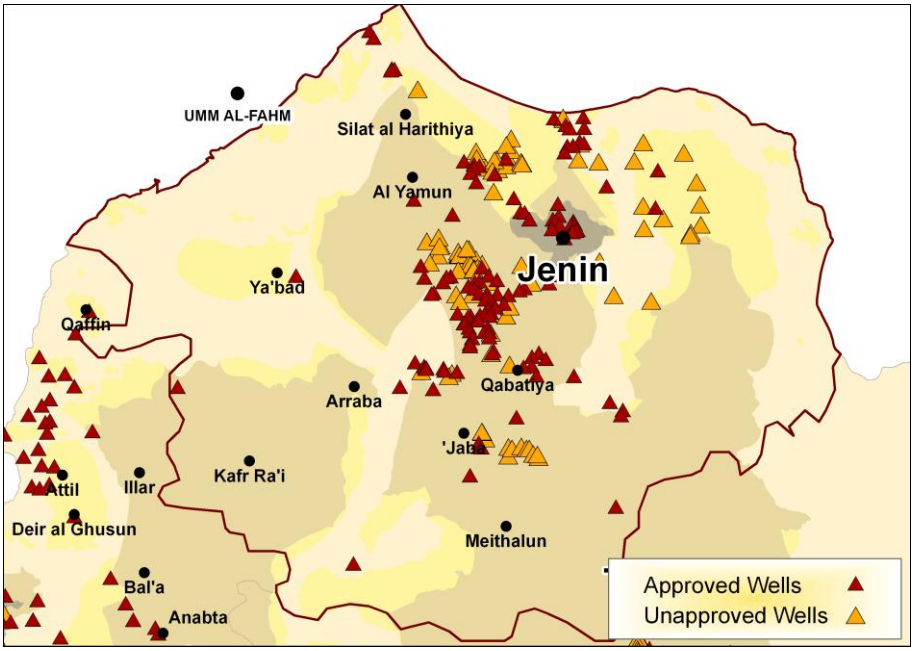
**Figure 4: A map of unapproved wells drilled by the PA since the 1995 Interim Agreement**



specifically in the western basin near Qalqiliyah and Tulkarm and in the northern basin near Jenin (see Figure 5), providing about 10 MCM/Y. Consequently, the Israeli extraction of groundwater from all three sub-aquifers has been reduced by the same amount in order to prevent the groundwater table from dropping below the sustainable level, which would deteriorate the water quality by salinization.

In addition, the Palestinians have in some instances hooked themselves up to Mekorot water pipelines without permission. In the villages of Sair and Ash-Shuyukh, for example, the unlicensed water connections are used to irrigate fields at the edge of the Judean desert. The consumption from these connections totals about 3 MCM/Y.

**Figure 5: A map of unapproved wells drilled by the PA in the Jenin Governorate since the 1995 Interim Agreement**



## PALESTINIAN PER CAPITA CONSUMPTION

### Total Per Capita Consumption

The Palestinians claim that the water consumption of the average Israeli is four times greater than that of the average Palestinian.[16] However, this claim is not factually supported. In 1967, there was indeed a large gap in the per capita consumption of water between Israelis and Palestinians. This was due to the ancient water supply systems that existed in Judea and Samaria under British and then Jordanian rule, which needed upgrading. This gap, however, was reduced during the Israeli administration period and the difference is now negligible.

When examining water consumption among Israelis and Palestinians (see Table 1), only "fresh, natural" water sources, which are under dispute, are considered. Treated sewage and desalinated seawater are artificial sources, which both sides can produce, and are not part of the fresh, natural water supply.

**Table 1: The changes in Israeli and Palestinian water consumption over 40 years**

| Year | Israel | | | Palestinians in Judea & Samaria | | |
|---|---|---|---|---|---|---|
| | Population | Natural water amount (MCM/Y) | Per capita consumption ($m^3$/y) | Population | Natural water amount (MCM/Y) | Per capita consumption ($m^3$/y) |
| **1967** | 2,776,000 | 1,411 | **508** | 700,000 | 65 | **93** |
| **2006** | 7,117,000 | 1,211 | **170** | 1,400,000* | 180 | **129** |

***This figure was calculated by the American-Israeli Demographic Research Group.

In 1967, Israel's total water consumption was 508 cubic meters per capita per year ($m^3$/c/y), while that of the Palestinians was 93 $m^3$/c/y. But by 2006 the gap had significantly narrowed to 170 $m^3$/c/y for Israelis and 129 $m^3$/c/y for Palestinians (see Table 1). The acute decrease in per capita fresh, natural water consumption has taken place in Israel due to both the natural decrease in available water and the dramatic increase in population. At the same time, a very significant rise in per capita fresh, natural water consumption has

taken place in the Palestinian communities in spite of the population increase, due to the dramatic advancement in water supply systems. Since 2006, these trends have continued due to the drilling of 15 new wells for Palestinian consumption that produce 15 MCM/Y. The current per capita consumption is 150 $m^3$/c/y for Israelis versus 140 $m^3$/c/y for Palestinians.

The significant increase in Palestinian per capita water consumption over the last few decades is a unique phenomenon. While general global trends indicate a decrease in per capita consumption over time due to population growth and deterioration of water resources,[17] the Palestinians exhibit the opposite trend due to their increased access to water since 1967.

The Palestinians' claim about a larger gap in per capita water consumption arises from a discrepancy in the recorded official number of Palestinians living under the PA. The Palestinian Central Bureau of Statistics (PCBS) reported in 2004 on 2.4 million Palestinians residing in Judea and Samaria, while the American-Israeli Demographic Research Group (AIDRG) calculated only 1.4 million.[18] The numbers used in this paper (see Table 1) are based on evidence from both estimations. A major part of the discrepancy between the PCBS and AIDRG results from the different definitions of *de facto* residents used by each. For example, the PCBS includes the 250,000 Palestinians living in East Jerusalem and the 150,000 Palestinians who immigrated to Israel through marriage and the family unification program, while the AIDRG does not include these individuals because they are actually Israeli citizens. Since these 400,000 Palestinians are connected to the Israeli water supply systems, they are included as part of the Israeli population (7.1 million) in Table 1 and should not be counted again as Palestinian residents. Additionally, the PCBS has increased the supposed number of *de facto* Palestinian residents by 400,000 by including those who have been living abroad for many years, while the AIDRG excludes this group in its count. Obviously, they are not consuming water from the Palestinian water supply system. The remaining discrepancy results from different calculations and predictions surrounding birth, death and immigration rates. It is worth noting that the AIDRG assessment relies on clear cut data and actual measurements, such as

registration of births, enrollment of first graders in schools, and reports on exits and entries at the border crossings.[19] As this paper aims to evaluate the Palestinian consumption of water from Palestinian water supply systems, the figure of 1.4 million has been adopted.

For the sake of comparison, the per capita consumption of natural, fresh water in Israel (150 $m^3$/c/y) and in the PA (140 $m^3$/c/y) are less than that of their Middle East neighbors,[20] such as Jordan (172 $m^3$/c/y), Egypt (732 $m^3$/c/y), Syria (861 $m^3$/c/y) and Lebanon (949 $m^3$/c/y). Israel overcomes this water shortage by recycling sewage for agricultural irrigation, and by desalinating seawater for domestic use. However, in many of these adjacent countries, most water is used for (inefficient) agricultural irrigation, creating severe shortages in domestic water supply in the cities and towns.

**Domestic Per Capita Consumption**

While the above analysis looks at the total amount of water use by the population, it is often argued that per capita water consumption should be calculated based only on domestic needs, to the exclusion of agricultural needs.

Palestinian per capita domestic water consumption in 2006 was 82 MCM/Y, or 58 $m^3$/c/y. Comparatively, Israeli per capita domestic consumption in 2006 was 84 $m^3$/c/y (including 11 percent leakage). The water supply gap between Israelis and Palestinians – 84 versus 58 $m^3$/c/y in 2006 – reflects the difference in standard of living of the two societies. Such gaps exist within Israel as well: for example, between the two main metropolises of Jerusalem and Tel Aviv, where the per capita domestic water consumption was 65 and 115 $m^3$/c/y respectively in 2006.

According to the PA, however, roughly 33.6 percent of their water leaks from the internal pipelines.[21] Due to this severe leakage, the net per capita domestic consumption in 2006 was actually 55 MCM/Y, or 39 $m^3$/c/y. In Israel, leakage figures have been reported at 11 percent. Nonetheless, the net per capita domestic water consumption of the Palestinians is still greater than the minimum human need estimate

given by the World Health Organization[22] – 100 liters per day per capita (36.5 $m^3$/c/y). And, this quantity is much above the "minimum to sustain life," which is defined by environmental scientist Peter Gleick[23] as 50 liters per day per capita.

## WATER SUPPLY SYSTEMS IN JUDEA AND SAMARIA

The total water consumption of the Palestinians was 178 MCM/Y in 2006, including 82 MCM/Y for urban use and 96 MCM/Y for agriculture. Water for domestic consumption was delivered in two ways: 42 MCM/Y by Palestinian self-supply and 40 MCM/Y by Israeli plants. Agricultural water was also delivered in two ways: 90 MCM/Y was supplied directly by the Palestinians, while 6 MCM/Y was supplied by Israeli plants. These numbers do not include the unauthorized wells and connections made by the Palestinians.

### Types and Locations of Water Supply Plants

Details of the water supply plants in Judea and Samaria – their geographical location, annual capacity and consumers – are given in Figure 6 and Table 2. The plants are divided into four categories:

1. Israeli domestic plants: These water pipe networks are actually "branches" of the National Water Carrier that run along the Mediterranean coastal plain. Managed and maintained by Mekorot, they supply water to the Israeli settlements in Judea and Samaria and to the nearby Palestinian villages. There are six plants of this type.

2. Palestinian domestic plants: These are managed and maintained by the Palestinian Water Authority (PWA) or the Palestinian municipalities. Originally, these were based on local wells and springs, but later the plants were expanded with water diverted from Israeli plants (about 50 percent of their total water supply). There are four plants of this kind.

3. Israeli agriculture plants: Located in the Jordan River Valley, these plants supply water to the Israeli settlements and to the nearby Palestinian villages and are managed and maintained by

**Table 2: Geographical distribution of water supply plants in Judea and Samaria and their annual transfer amounts in 2006**

| Category | Plant name | Annual transport (MCM/Y) | Details |
|---|---|---|---|
| **Israeli domestic plants** | North Samaria | 1 | Includes 0.5 to Palestinians |
| | Central Samaria | 14 | Includes 6 to Palestinians (2 to Nablus and 4 directly) |
| | West Benjamin | 6 | Includes 2 to Palestinians |
| | Jerusalem periphery | 23 | Includes 16 to Palestinians (10 to Ramallah, 2 to Bethlehem-Hebron, and 4 directly) |
| | Etzyon-Judea | 20 | Includes 15 to Palestinians (11 to Bethlehem Hebron, and 4 directly) |
| | South Hebron Mountains | 1 | Includes 0.5 to Palestinians |
| | **Total:** | **65** | Includes **40** to Palestinians (**25** to domestic plants, and **15** directly) |
| **Palestinian domestic plants** | Jenin | 4 | |
| | Nablus | 10 | Includes 2 from Central Samaria |
| | Ramallah | 13 | Includes 10 from Jerusalem periphery |
| | Bethlehem-Hebron | 23 | Includes 11 from Etzyon-Judea and 2 from Jerusalem periphery |
| | **Total:** | **50** | Includes **25** from Mekorot |
| **Israeli agriculture plants** | Mehola | 7 | Includes 5 to Palestinians |
| | Central Jordan Valley | 21 | Includes 1 to Palestinians |
| | Kane springs | 1 | |
| | **Total:** | **29** | Includes **6** to Palestinians |
| **Palestinian agriculture plants (a group of wells and springs)** | Jenin District | 16 | |
| | Tulkarm District | 21 | Includes 8 for domestic use and 13 for agriculture |
| | Qalqiliyah District | 20 | Includes 5 for domestic use and 15 for agriculture |
| | Faria-Giftlik | 21 | |
| | Uja | 14 | |
| | Jericho | 15 | Includes 4 for domestic use and 11 for agriculture |
| | **Total:** | **107** | Includes **17** for domestic use and **90** for agriculture |

Mekorot. Unlike the domestic ones, these plants are based on local wells. There are three plants of this type.

4. Palestinian agriculture plants: These are not in fact plants by definition as they are not integrated systems (which include pumping stations, pipelines, storage reservoirs and distribution systems) but merely collections of independent wells and springs, each supplying water to the adjacent field or houses. These plants are concentrated in six locations.

**Domestic Water Plants**

Each of the arrows and circles in Figure 6 represent a water supply plant. These plants include complex wells, pumping stations, pipelines, reservoirs, pressure zones and distribution networks. Each of the plants supplies water to tens or hundreds of thousands of people living in tens of communities.

Figure 7 shows the geographical distribution of two water supply plants, the Israeli Central Samaria one (marked in blue) and the Palestinian Nablus one (marked in red), and their interconnections. The volume of water transferred from Mekorot to the PA is measured at each connection.

Figure 8 shows the geographical distribution of three additional water supply plants, the Israeli West Benjamin and Jerusalem Periphery ones and the Palestinian Ramallah one, and their interconnections.

Figure 9 shows the geographical distribution of three other water supply plants, the Israeli Etzyon-Judea and South Hebron Mountain ones and the Palestinian Bethlehem Hebron one, and their interconnections.

**Figure 6: A map of water supply systems in Judea and Samaria**

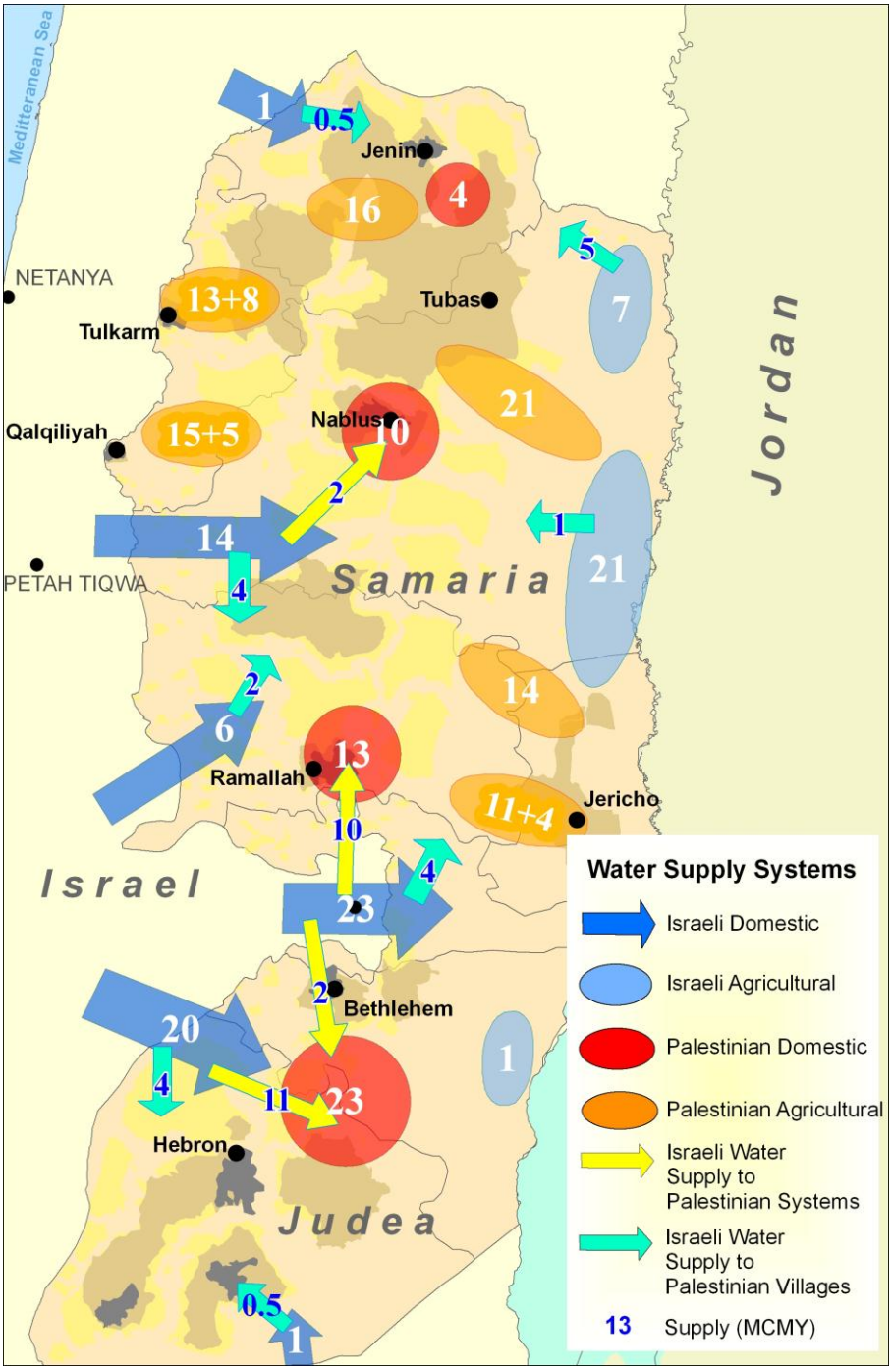


**Figure 7: A map of water plants in the Samaria Mountains**

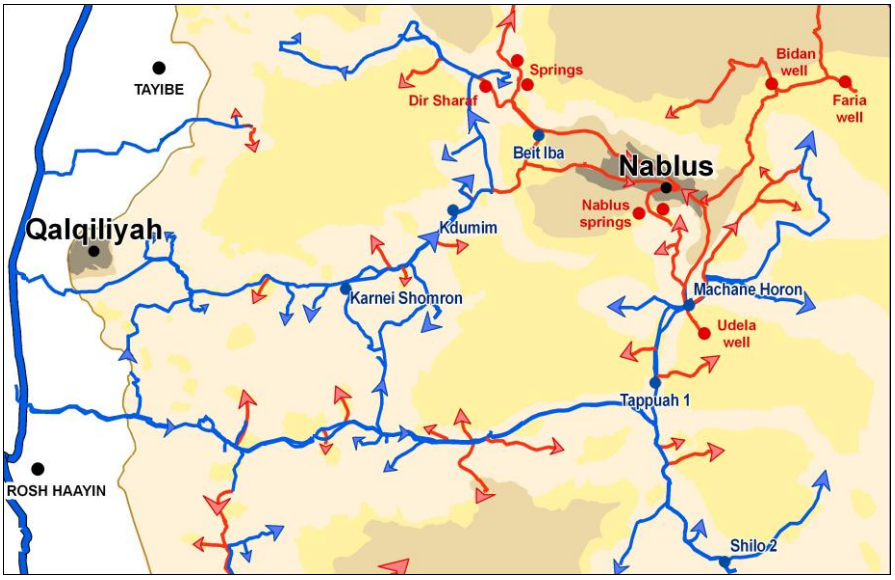



**Figure 8: A map of water plants surrounding Jerusalem**

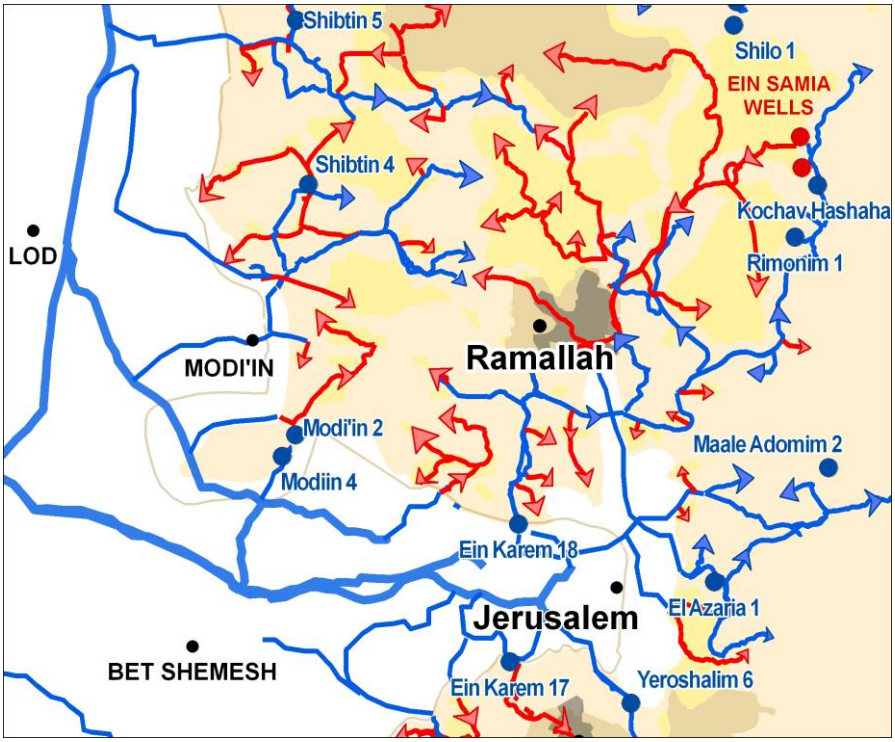


**Figure 9: A map of water plants in the Judean Mountains**

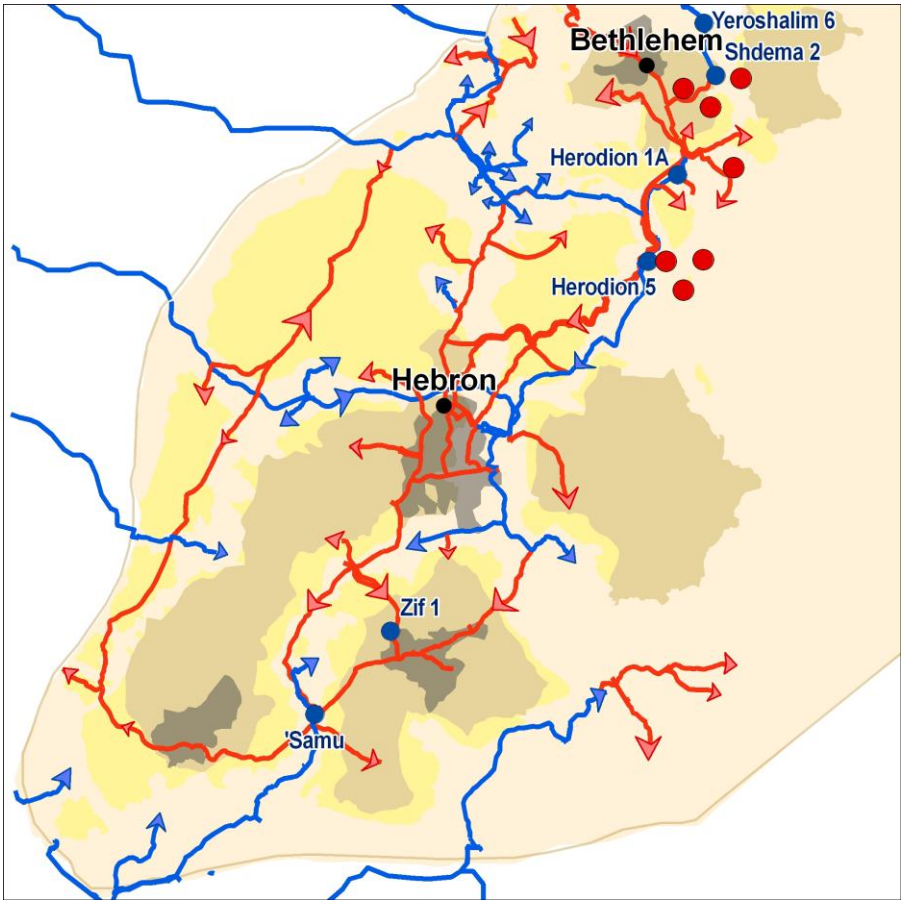
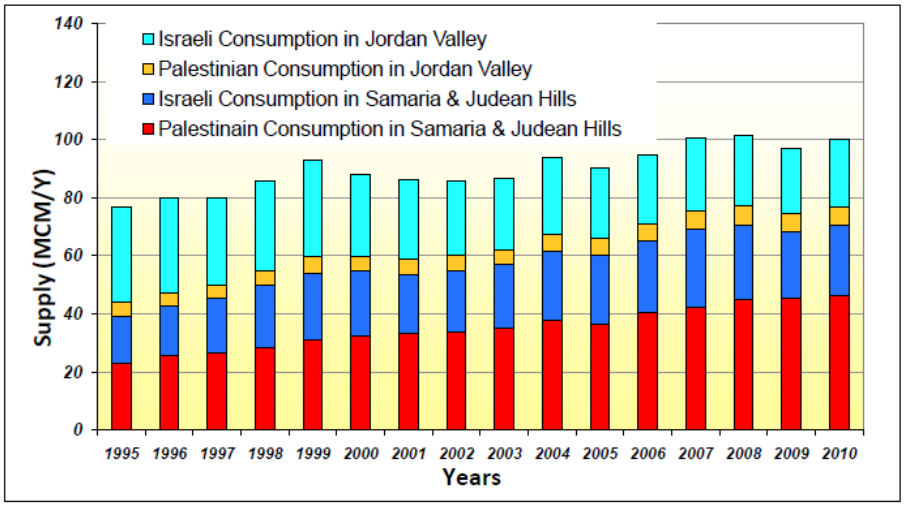



Figure 10 shows the increase in water supply coming from the Israeli plants (six domestic and three agricultural) in the years 1995-2010. In 2010 these plants supplied 100.1 MCM/Y – 52.7 MCM/Y to Palestinian consumers and 47.2 MCM/Y to Israeli consumers. In other words, 53 percent of the water transferred by the Israeli plants was supplied to Palestinians. Moreover, during these years Mekorot increased the available water supply by 31 percent, from 76.6 MCM/Y to 100.1 MCM/Y. This supplement aimed to satisfy increasing Palestinian water needs (from 28.0 MCM/Y to 52.7 MCM/Y), as the Israeli water needs during this period did not change. These numbers do not include water pumped independently by the Palestinians.

**Figure 10: The increased supply of water (in MCM/Y) to Israelis and Palestinians in Judea and Samaria from 1995**




The data demonstrates that the rate of development of the Palestinian water infrastructure since the signing of the Oslo agreements has been insufficient and that Palestinian water needs have only been met due to significant Israeli reinforcement. Moreover, despite the international aid offered to the Palestinians for planning and financing, including the approval of 70 new wells by the JWC, the Palestinians have not succeeded in independently increasing their water supply. This is mainly due to mismanagement,[24] faulty maintenance (e.g. the collapse of tens of well pumps and electrical control systems), hydrological errors (e.g. drilling adjacent wells at Herodion, which caused their drying due to the development of a deep cone of depression at the water table) and engineering miscalculations (e.g. overlapping water pipeline nets donated by the Americans and Germans, resulting in the faulty functioning of both).

## Sewage Plants

In contrast to the extensive improvement of water supply installations, mainly due to Israel's assistance, no significant progress has been made by Palestinian wastewater treatment plants. Raw sewage discharged from Palestinian communities in Judea and Samaria flows freely in many streams.[25] For example, the Hebron Stream, which

flows towards the Be'er Sheva Valley, has become a polluted wastewater channel, and the nearby Palestinian villages and Israeli settlements suffer badly from polluted water, odors, flies and mosquitoes. Another example is the Nablus Stream, which flows towards the coastal plain and has become a wastewater channel for Nablus and Tulkarm. Many additional streams (e.g. Kishon, Alexander, Modiin and Kidron) have become wastewater depots as well. The untreated wastewater infiltrates the groundwater of the Mountain Aquifer, deteriorating its quality and contaminating wells downstream (e.g. Mitzpe Jericho 6, Na'aran 2, Beit Fajjar, Al Azzariya 1). The absence of wastewater treatment by the Palestinians and the parallel expansion of water supply networks have led to increasingly severe environmental pollution.

The quantity of wastewater generated by the Palestinians at present is estimated at about 52 MCM/Y. Of this, only about 4 MCM/Y is treated in Palestinian plants, roughly 14 MCM/Y is treated in Israeli plants, and the rest (about 34 MCM/Y) pollutes the groundwater and the environment. Apart from the wastewater treatment plant at El-Bireh, no new plants have been constructed in the past 15 years, and even this plant is not maintained properly – its effluent is not used for agriculture, as planned, but is discharged to Wadi Qelt, thereby contaminating it. Furthermore, the Palestinians, possibly due to negligence, have allowed sewage to flow into Israeli territory, polluting the environment and the common aquifer. In stark contrast, 90 percent of the wastewater from Israeli settlements is already undergoing treatment.

The Palestinians have not advanced wastewater treatment projects even though several countries, namely Germany, the US and Japan, and the World Bank have expressed their willingness to allocate considerable funds for the construction of these vital plants. This is despite the fact that JWC-approved programs already exist for the treatment of wastewater in Nablus, Tulkarm, Jenin, Salfit, Ramallah, Kidron, Hebron, the central Gaza Strip, and other areas.

## LEGAL ASPECTS OF THE WATER AGREEMENTS

International law regarding trans-boundary water resources has developed in stages.[26] The International Law Association (ILA) published in 1966 the Helsinki Rules on the "Uses of the Waters of International Rivers," which dealt mostly with navigational uses. In 1986, the ILA published the Seoul Rules on "The Law of the Non-Navigational Uses of International Watercourses," addressing the consumption of surface water. Finally, in 2004, the ILA published the Berlin Rules regarding groundwater resources.[27] Although these rules do not constitute a binding international treaty, they are widely regarded as reflecting the norms of customary international law.

In addition, the 1997 convention on the "Non-Navigational Uses of International Watercourses," drafted by the UN International Law Commission (ILC), regulates the rights and obligations of riparian states. Although this convention has yet to be instated (as only 16 of the required 35 states have ratified it), its core principles were regarded by the International Court of Justice as reflecting customary law in the case of the Hungary/Slovakia Gabcikovo-Nagymaros Project.[28] It is worth noting, though, that the UN rules apply to the division of shared surface water resources only and not to groundwater.

Today, two basic rules are viewed as customary in the use and division of shared international water resources: the principle of "equitable and reasonable use" and the principle of "prevention of significant harm."[29] The implementation of these two principles is complex, as neither the Helsinki/Berlin Rules nor the UN convention provides a clear mathematical formula for the division of shared waters. However, they act as the guiding criteria by which the majority of water-related disputes worldwide are resolved. Solutions are primarily pragmatic and do not strictly adhere to "dry" legal principles.[30]

### The Superiority of a Signed Agreement

Since it is difficult to quantify the various criteria outlined in international legal norms, signed agreements between countries are

considered binding on the parties and cannot be overruled by customary legal principles. Consequently, the 1995 water agreement signed by Israel and the PA leaves no room for further demands by the Palestinians. This agreement quantified the Palestinians' "future needs" as approximately 70-80 MCM/Y in addition to the 118 MCM/Y already available to them. As shown in the previous sections, Israel has met its obligations regarding water supply, not only for the interim period, but also for any future final status agreement.

The Palestinians' current demands are not only unjustified according to international legal norms but also fall short according to several international legal parameters regarding disputed water resources, as discussed below.

**Natural Characteristics of the Mountain Aquifer**

Geographical and hydrological factors are among the natural parameters according to which shared water resources should be divided. Since the natural replenishment of the Mountain Aquifer (by rainfall) takes place principally in the area that is or will be part of Palestinian territory, the Palestinians claim that all or most of this water belongs to them. This claim, however, ignores the fact that the geographical and hydrological characteristics of the aquifer include not only the replenishment areas but also the discharging areas.[31] As seen in Figure 11, the Mountain Aquifer is discharged through major springs located west and north of the Green Line – specifically the Yarkon springs (which naturally collect 220 MCM/Y) and the Taninim springs (which naturally collect 110 MCM/Y) in the western basin, and the Harod and Beit Shean springs (which naturally collect 110 MCM/Y) in the northern basin. Also, the storage areas of the aquifer are not located beneath the replenishment area, but rather beneath the discharge areas, as the water flows eastward and westward away from the replenishment area (see Figure 12).

**Figure 11: A map of the three Mountain Aquifer basins and their average water potential as defined in the Interim Agreement**[32]

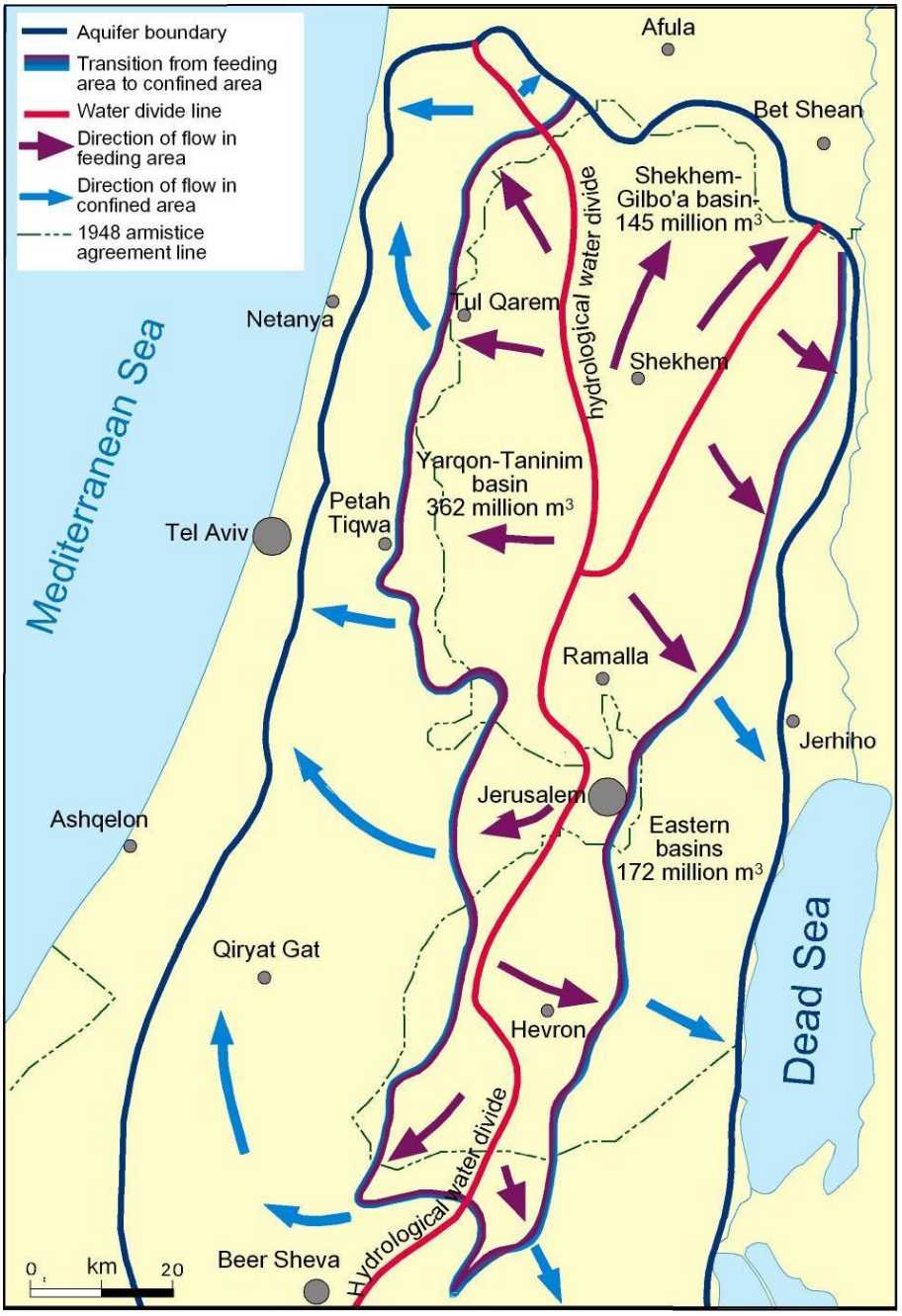
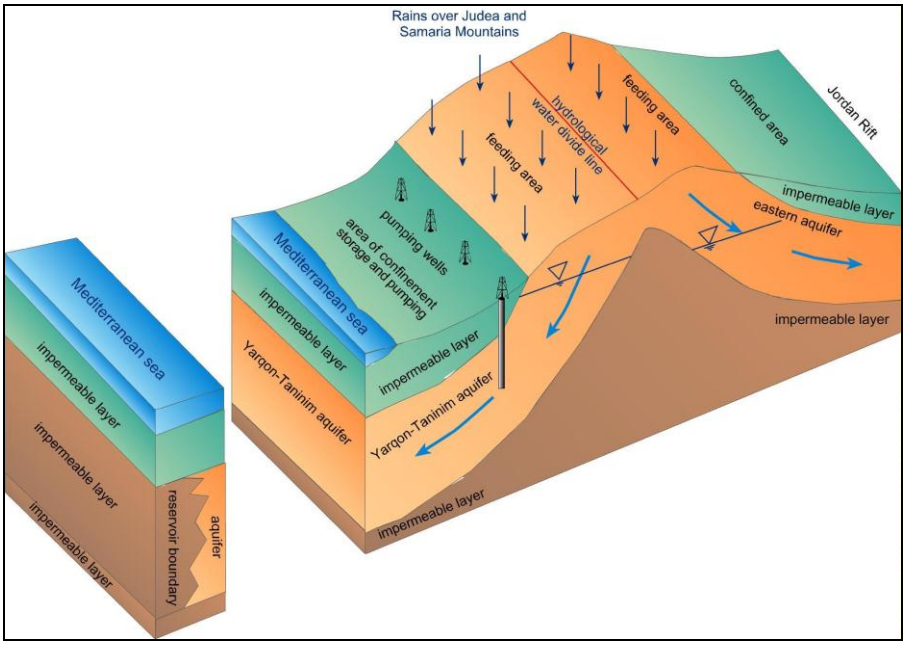


**Figure 12: A schematic cross-section of the Mountain Aquifer showing the recharge and storage areas of the eastern and western basins**[33]




## Historical Usage

According to international legal norms, existing water usage – both domestic and agricultural – is an important parameter for defining the future usage of a shared water resource because this accurately reflects human consumption needs. Consequently, since Israel utilized the majority of the Mountain Aquifer water prior to 1967, it can claim historical ownership.

At the beginning of the twentieth century, all water from the Western Mountain Aquifer drained through the Yarkon and Taninim springs and created extensive swamps along the coastal plain. The Jews settling in pre-state Israel dried the swamps and extracted the water from the springs during the 1920s, 1930s and 1940s. Similarly, they dried the swamps in the Jezreel Valley, Harod Valley, and Beit Shean Valley,[34] where the water from the Northern Mountain Aquifer had emerged. After a short period of accelerated development, both basins

became fully utilized by Israel. In 1967, when Judea and Samaria came under Israeli control, no changes in water usage were made.[35] This indicates that historical water usage is unrelated to the Israeli takeover of this area.

Before 1967, Israel used 340 of the 360 MCM/Y available in the western basin of the Mountain Aquifer, and the Palestinians used 20 MCM/Y. From the Northern Mountain Aquifer, Israel used 115 of the total 140 MCM/Y and the Palestinians used 25 MCM/Y. On the other hand, the Palestinians historically used more water from the Eastern Mountain Aquifer than Israel did, consuming 65 MCM/Y and 35 MCM/Y respectively.[36] The groundwater that Israel currently pumps from this basin consists of water that previously flowed to the Jordan Valley or to the Dead Sea (which became saline) and was never exploited by the Palestinians.

It is important to note the importance of the Mountain Aquifer for Israel. It supplies water to the inhabitants of the two largest metropolises, Jerusalem and Tel Aviv, as well as to most towns along the coastal plain. Also, it supplies water to Israeli farmers on the coastal plain and in the lowlands (*Shefela*), the northern valleys and the Be'er Sheva Valley.

**Available Alternative Water Sources**

International law prioritizes the use of unexploited water sources prior to reallocating exploited sources. The Eastern Mountain Aquifer, the only water source between the Mediterranean Sea and the Jordan River that is not fully exploited, was offered by Israel to the PA for drilling and development. Yet, the PA has been drilling in the western and northern basins – this not only harms the water quality due to potential salinization but also reduces Israel's access to these resources.

**Water Conservation and Efficient Usage**

The issue of sustainable development has become increasingly significant worldwide. With regard to water resources, sustainable development dictates the use of water in a responsible manner to

ensure its sustainability in the future, both in quantity and quality.[37] In line with this principle, all water supply programs should be based on the following practices: reduction of water losses, conservation of water, treatment of wastewater, prevention of contamination, and habitual monitoring to ensure optimal management. Israel has adopted all of these practices along with many other techniques for ensuring optimal, responsible and sustainable water usage. These include: multi-annual and seasonal water storage; red line decision making policies for the Sea of Galilee and the major aquifers; consolidation of all water sources to ensure reliability of supply; sewage treatment and reuse; desalination of seawater and saline groundwater; regulated water allocation; progressive pricing based on socio-economic factors; water pumping taxes for private wells; efficient maintenance of pipelines; monitoring and hydrometry; monetary water conservation incentives; consumer and municipal associations that manage the pipeline distribution system; training of professionals; and research initiatives.

In contrast, the PA does not uphold basic sustainability principles nor has it adopted other such responsible management practices. Following are some of the more extreme examples.

Most Palestinian farmers have not installed meters on their wells and do not monitor the volume of water they use, and about half of the houses in the Palestinian towns and villages in Judea and Samaria have no meters. Consequently, most Palestinians do not pay for their water consumption since the PA has no way of tracking their usage. With no monetary incentive to conserve water, the Palestinian population will continue to waste this valuable resource, moving away from, rather than towards sustainable development.

To avoid financial losses to Mekorot, monthly payments are made by the Government of Israel to Mekorot. However, these payments do not affect the individuals who are not monitoring their water use and who are not paying for it. Therefore, no incentives exist for water conservation, and such behavior opposes sustainable development

International law requires that water not be wasted. But according to the PWA, water leakages from their pipe system average 33.6

percent.[38] Additionally, the use of flood irrigation (instead of sprinkler systems and drip irrigation, as is done by Israeli farmers) causes huge water waste. As well, the lack of sewage treatment in Palestinian towns – in violation of international legal tenets to preserve the quality of water resources and avoid pollution – has caused grave damage. Purifying the wastewater would reduce the pollution levels, preventing the contamination of groundwater and the environment, and enable the use of effluent for irrigation.

It is evident, then, that the Palestinian population makes no effort to manage its water resources according to the basic rules of sustainable development. In accordance with international law, such irresponsible behavior precludes the PA's demands for additional water allocations.

## THE FORTHCOMING PERMANENT STATUS

The region under consideration suffers from a severe water shortage due both to its semi-arid climate and to its increasing population. It is clear that the existing natural water resources are insufficient to meet present and future water needs. But in order to solve the issue of Palestinian water shortages, a fair and sustainable solution should be sought – not one that will instead exacerbate Israel's water scarcity. Such a solution will necessitate an increase in the overall availability of water in the region, better conservation practices, increased efficiency (i.e. less water loss in urban centers and higher yield per water unit consumed in agriculture), and substantial upgrading of the entire water supply system, both for Israel and the Palestinians.

### Ideology versus Practice

In past negotiations, the Palestinians have attempted to include "water rights" as part of any final status agreement. The Israelis, on the other hand, have insisted on discussing practical solutions, namely the allotment of water resources in accordance with the need. The practical approach has proven to be successful in various worldwide water conflicts, such as the dispute over the Mekong River between Cambodia, Laos and Vietnam; the controversy over the Indus River between India and Pakistan; and the disagreement over the Nile River between the 10 basin riparian countries.[39] In Israel, this approach has

prevailed in two instances: the first is Israel's 1994 agreement with the Kingdom of Jordan, which does not include the subject of water rights. The second is the 1995 interim agreement with the Palestinians, where the water rights issue was postponed. If the issue of water rights is again raised by the PA, the negotiations are unlikely to be fruitful.

## Quantifying Palestinian Water Rights

The future water needs of the Palestinians according to the 1995 Interim Agreement are 70-80 MCM/Y in addition to the already consumed 118 MCM/Y that year. This means that in Judea and Samaria the Palestinians must be ensured access to roughly 200 MCM/Y. In 2006, the total water consumption of the Palestinians was 178 MCM/Y – 132 MCM/Y (used mainly for agriculture) was self-supplied and 46 MCM/Y was purchased from Israel (see Figure 6 and Table 2). Considering the increase since 1995, as well as the unauthorized wells and connections, the Palestinians currently consume close to the 200 MCM/Y that have been designated for them, meaning that they have reached the water goal set out for them. Nevertheless, it is suggested in this paper that several additional water sources be designated for Palestinian use: the Eastern Aquifer, domestic and agricultural savings, treated sewage, and desalinated seawater.

## Practical Solutions

As has been the case in Israel, increasing the Palestinian water supply can be achieved by improving water use efficiency and wastewater development. The immense water savings that would accrue as a result of plugging leaks in urban pipes is at least 10 MCM/Y, though obviously it is impossible to totally prevent leaks. In addition, the great savings that would result from improving irrigation techniques is at least 15 MCM/Y, which could contribute significantly to the water supply for agricultural lands. Furthermore, the collection and treatment of urban sewage would produce at least 30 MCM/Y to be used for irrigation. This enormous amount would replace freshwater that could be used instead for domestic purposes. Finally, seawater

desalination plants could supply any quantity of water that the Palestinians desire.

Detailed engineering plans for all of these new water sources either already exist or could be easily drafted from similar generic plans. Leak plugging and modern irrigation techniques should be implemented without further delay. Detailed programs for sewage treatment plants have existed for many years and must simply be signed by the Palestinians. Sewage effluents could be utilized locally, and surpluses (especially in Nablus and Ramallah) should be transferred to Palestinian farmers in the Jordan Valley. Furthermore, the Gaza Strip sea coast can be used for the construction of several desalination plants. This method would also enable the polluted aquifer of the Gaza Strip to be rehabilitated.

Considering the rate of increase of the Palestinian population and its per capita future water consumption, the proposed steps would supply the quantity of water needed and even leave some reserves, as is shown by the following calculations. In the Gaza Strip, desalination plants could supply any desired amount of water. In Judea and Samaria, the current number of people using water from Palestinian supply plants is 1.4 million and the annual population increase is 1.8 percent.[40] Thus in 2030 there will be about 2.15 million people. Assuming a per capita consumption rate of 150 liters/day (40 percent above the current rate), the total domestic consumption in 2030 will be 118 MCM/Y. The above-mentioned programs would supply the necessary additional water resources, leaving some reserves for agricultural development.

## CONCLUSION

This paper details the water agreements between Israel and the Palestinians and in doing so refutes any criticism against Israel for not adhering to its commitments. Israel has not only fulfilled all of its obligations stemming from the 1995 Interim Agreement signed with the PA but has met all water commitments requisite of a permanent status agreement as well.

As a result, there is almost no difference today in the per capita consumption of natural water between Israelis and Palestinians. The large difference that existed in 1967, when the administration of Judea and Samaria was handed over from Jordan to Israel, has been reduced over the last 40 years and is now negligible. As well, the per capita domestic water consumption of the Palestinians is significantly higher than the minimum human needs defined by the World Health Organization.

However, while Israel has ensured that nearly all Palestinian villages and towns are connected to running water, the Palestinians have violated their part of the agreement by refusing to build sewage treatment plants (despite available international financing). Moreover, the Palestinians have drilled hundreds of unlicensed wells and set up unauthorized connections to Israeli water supply pipelines.

Furthermore, the Palestinians have little basis for their water demands according to international legal norms. First, the signed water agreement overrules all other parameters. Second, Israel's historical possession of the Mountain Aquifer was established in the 1940s and is unconnected to the Occupation. Third, the Palestinians should not exploit groundwater from the Western Aquifer, which is fully utilized by Israel, before first exploiting groundwater from the non-utilized Eastern Aquifer. Finally, the Palestinians should be working to pay individually for their water consumption, to prevent leaks in domestic pipelines, to implement conservative irrigation techniques, and to reuse sewage water for irrigation. The fact that they have taken none of these steps and have not adopted any sustainable development practices precludes their demands for additional water from Israel.

Israel believes that the water issue could be transformed from a source of controversy and tension to a source of understanding and cooperation.[41] As with its two previously signed water agreements (the permanent one with Jordan in 1994 and the interim one with the Palestinians in 1995), Israel wishes to achieve a practical and fair permanent agreement with the Palestinians. This paper has put forth a plan that can efficiently and quickly solve the current and future water shortages on both sides. The proposed plan would supply the

sufficient quantity of water needed at least until 2030 and still leave some reserves.

## Acknowledgments

I thank my colleagues for the helpful discussions conducted during meetings of a brainstorming committee, including Uri Shani, Baruch Nagar, Miki Zaida, Uri Shamir, Yosi Drazin, Moshe Izraeli, Noach Kinarti, Joshua Schwartz, Yosi Gutman, Karlos Karsia, Avi Atias, Amnon Cohen and Adi Sheinman. Also, I acknowledge important comments on the manuscript by Eran Feitelson, Eyal Benvenisti, Efraim Inbar, Brian Berkowich, Harvey Blatt, Elisheva Blusztejn, Lisa Perlman and Ilana Hart. Those who commented on the manuscript do not necessarily agree with all of its contents. This paper does not necessarily represent the position of the Government of Israel on water issues.

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